

Serial No.: 10/771,041
Conf. No.: 1542

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Art Unit: 2859

In the Drawings

Replacement Sheets is attached which include a clean version of amended Figures 1, 2, 3a – 3e and 4a-4c. The attached sheets replace the original sheets including such Figures.

The only amendments to those figures is the addition of the legend “Prior Art”.

REMARKS

Applicant respectfully requests reconsideration. Claims 1-39 were previously pending in this application. Claims 1 and 25 have been amended. No new claims have been added and none have been canceled. As a result, claims 1-39 are pending for examination.

Specification

An objection was made to the abstract as exceeding 150 words. A shorter abstract has been substituted.

Drawings

Certain drawing figures were objected to as requiring "prior art" legends. Suitable amended sheets are provided herewith.

Claim Objections

A grammatical error was noted in each of claims 1 and 25. The error has been corrected in the manner suggested by the Examiner.

Rejections Under 35 U.S.C. §102

The Examiner rejected claims 1, 2, 16, 18, 19, 25, 36 and 38 under 35 U.S.C. §102(e) as being anticipated by Ehnholm, et al. U.S. Patent No. 6,366,092. Reconsideration is requested.

Applicants submit herewith the Declaration of Dr. Daniel K. Sodickson under 37 C.F.R. 1.131 to remove the cited reference as prior art against the claimed invention. In view of this submission, Applicants respectfully request withdrawal of the rejection under 35 U.S.C. §102(e).

The purpose of the Sodickson Declaration submitted herewith is to establish both actual reduction to practice of the claimed invention in the United States as of a date prior to December 23, 1999, which is the filing date appearing on the Ehnholm et al. reference, entitled "Magnetic Resonance Imaging," and conception of the claimed invention prior to December 23, 1999 coupled with diligence toward a constructive reduction to practice.

To establish both conception and reduction to practice of the claimed invention, the Sodickson Declaration includes Exhibit A which is an invention disclosure prepared and dated prior to December 23, 1999. Exhibit A should be understood in the context of the state of the art exemplified, for example, by Exhibit B which is a published patent in which Dr. Sodickson is the inventor. The Exhibit B patent was filed November 12, 1996. The Exhibit A invention disclosure reports a successful reduction to practice of the claimed invention, as shown by reproductions of images obtained from said invention.

Independent claims 1 and 25 of the pending application follow with reference designations (in parentheses) added as annotations. These designations will be used to facilitate a demonstration that the disclosure in Exhibit A corresponds to the claimed invention.

Claim 1 states a method of forming a magnetic resonance image, comprising:

- (1) providing a plurality of RF receiving coils, each said RF receiving coil having a different spatial sensitivity;
- (2) applying one or more RF pulses in combination with one or more gradient encoding steps;
- (3) measuring MR signals indicative of nuclear spins caused by the step of applying in the plurality of receiver coils to form a set of MR signals;
- (4) generating a set of encoding functions representative a spatial distribution of receiver coil sensitivities and spatial modulations corresponding to the gradient encoding steps;
- (5) transforming the set of encoding functions to generate a new set of functions representative of distinct spatial positions in an image; and
- (6) applying the new set of functions to the set of MR signals to form the magnetic resonance image.

Claim 25 states an apparatus for forming a magnetic resonance image, comprising:

- (7) means for applying one or more RF pulses in combination with one or more gradient encoding magnetic fields;

- (8) a plurality of RF receiving coils, each said RF receiving coil having a different spatial sensitivity and configured to measure MR signals indicative of nuclear spins perturbed by the means for applying to form a set of MR signals; and
- (9) a controller configured to generate a set of encoding functions representative a spatial distribution of receiver coil sensitivities and spatial modulations corresponding to the gradient encoding steps, transform the set of encoding functions to generate a new set of functions representative of distinct spatial positions in an image, and apply the new set of functions to the set of MR signals to form the magnetic resonance image.

Elements (1) and (7):

Exhibit A (page 3, paragraph 2) details a new approach to MR image acquisition known as “Parallel MRI,” which uses an array or plurality of RF coils. It is known in the art that each coil, in a multiple RF coil system, exhibits a different spatial sensitivity (Exhibit B, col. 4, line 29).

Elements (2) and (7):

Exhibit A (page 3, paragraph 2) states spatial encoding is performed using gradients in combination with RF pulses.

Elements (3) and (8):

Measured MR signal data, from RF coils, is comprised of a generalized series of projection of the underlying distribution of MR – active spins in the imaged volume (Exhibit A, page 4, paragraph 3).

Element (4):

Exhibit A, (page 4, paragraph 4) explains the MR signal detected is the result of a spatial integration of spin density against the sensitivity of the coil and against the sinusoidal spatial modulations generated by encoding gradients. In other words, the signal comprises integrations or projections of the spin density against distinct functions.

Element (5):

A matrix equation is obtained from the received MR signal data (Exhibit A, page 4, paragraph 4). Direct inversion of the matrix yields a matrix which when multiplied by the initial matrix produces the identity matrix, this represents transformation to a basis made up of distinct delta functions at each pixel of the image (Exhibit A, page 6, paragraph 1).

Element (6):

Exhibit A (page 7, paragraph 1) explains a method of numerical conditions where a new set of functions, diagonal matrix containing eigenvalues, is applied to the set of MR signals to form the magnetic resonance image.

Element (7):

A controller is a common apparatus in MRI imaging systems used to carry out specialized timing and other functions (Exhibit B, FIG. 1) and inherently is disclosed. A means for applying RF pulses is known in the art as seen in the schematic of an MRI imaging system in Exhibit B, FIG. 1.

The Sodickson Declaration evidence submitted herewith thus satisfies the requirements of 37 C.F.R. §1.131 in that it establishes prior reduction to practice as well as prior conception by the Applicant coupled with diligence. Indeed, within days of writing the invention disclosure, it was submitted to Applicant's employer's patent coordinator and, through her, to patent counsel, for preparation of a patent application. Preparation of the application followed with reasonable diligence by patent counsel. The evidence thus is sufficient to remove the cited reference as prior art against the claimed invention under either proof required by 37 C.F.R. §1.131.

In view of the foregoing, Applicants respectfully request that the Examiner reconsider and withdraw the rejection of claims 1, 2, 16, 18, 19, 25, 26, 36, and 38 under U.S.C. §102(e).

CONCLUSION

A Notice of Allowance is respectfully requested. The Examiner is requested to call the undersigned at the telephone number listed below if this communication does not place the case in condition for allowance.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 23/2825.

Respectfully submitted,
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Docket No.: B0662.70055US00
Date: October 28, 2004
x10/28/04x